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(54) **Rinsing apparatus**

(57) A rinsing apparatus (1) projects a curtain of water (5), for example to clean a conveyor belt in the paper industry, with the thickness (9) of the curtain (5) being defined between a fixed lip (7) and a lip (8) on a movable bar (14). A preponderant pressure in a rear chamber (16) repels the movable bar (14) to bear against micrometric stop screws (19). When the pressure in the rear chamber (16) is relieved, the pressure of liquid in the front chamber (12) repels the movable bar (14) and enlarges the gap (9). Impurities are thus automatically removed. In another embodiment, the bar (14) is movably carried by piston stems slidable in the fixed lip and in the rear structure of the apparatus, fluid pressure being directed onto the ends of the stems to move the bar (14).

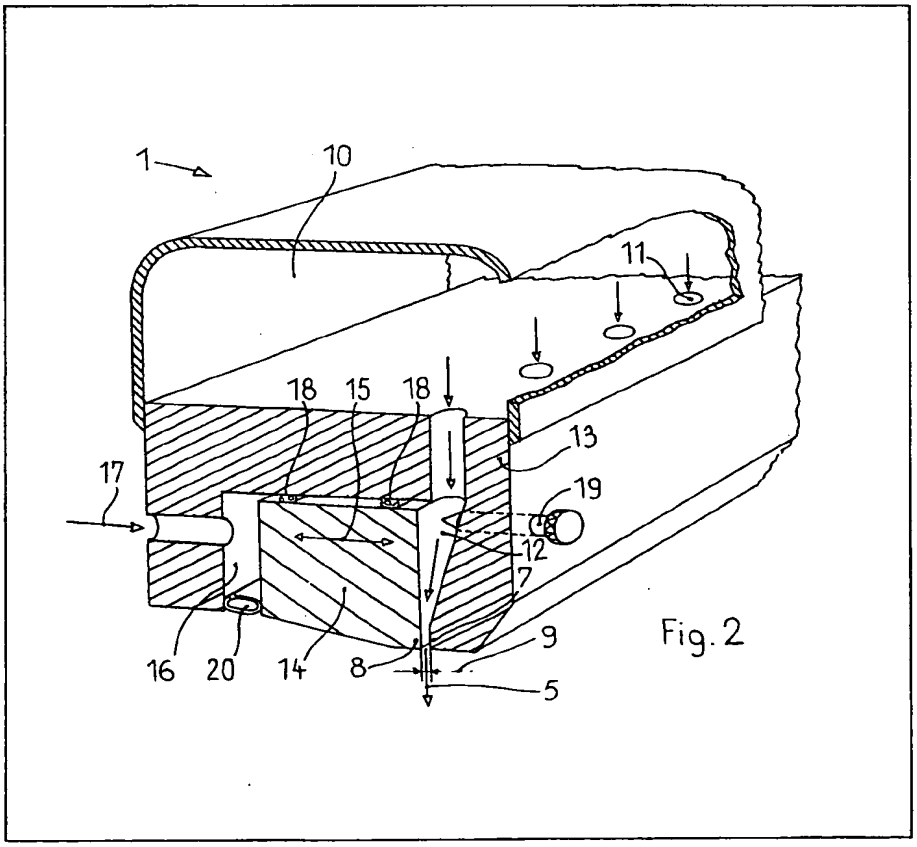

Fig. 2

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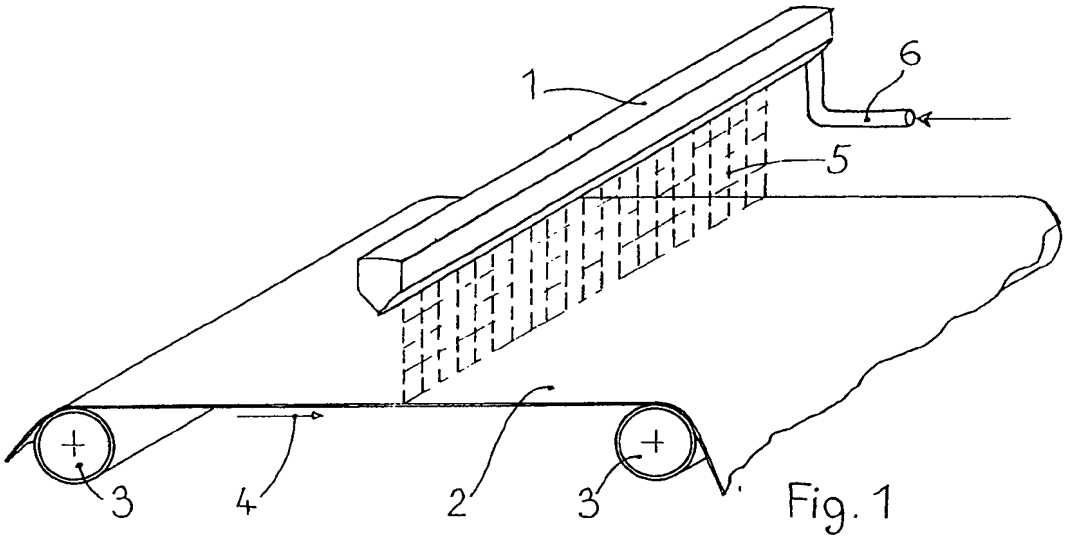

Fig. 1

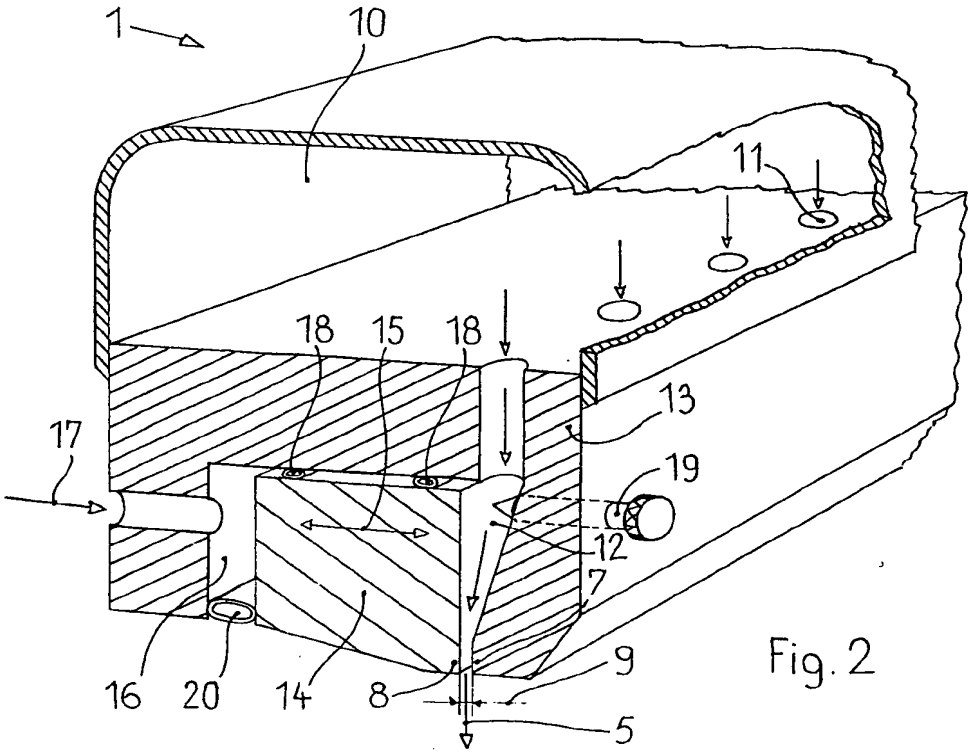

Fig. 2

A rinsing apparatus, mainly for the paper industry

The present invention relates to a new type of universal rinsing apparatus, which may be used for various applications, mainly in the paper industry, in cement factories, in gravel pits, or more generally, to clean any type of conveyor belt.

It is a known practice in these numerous applications, to use a conveyor belt, of which the carrying belt circulates continuously, to transport various materials, mainly powdery products in bulk, fibres, or paper pulp. The problem is to ensure the cleaning and rinsing of this belt when it is encrusted.

In the particular case of the paper industry, the belt is constituted by a cloth or a felt of which the texture must remain very fine, so as to allow the maximum retention of the fibres comprising the paper, and so as to mark the surface of the future sheet of paper as little as possible. The cleaning of such a cloth consists of removing the particles which are lodged in the interstices of the meshes of the cloth, so as to retain the latter's qualities of permeability. Now this operation is made increasingly difficult because of the speed of operation of the machines, which is constantly increasing, whilst also the dimensions of the meshes of the cloth tend to become increasingly smaller. This problem of cleaning is extremely important, for a clogged area of the cloth corresponds to a thin area on the paper, or even to a hole in the sheet of paper.

The cleaning of the felts or cloths which transport the sheet of paper into the press section of a paper machine, or into the drying zones, is also equally important, for an uncleaned area corresponds to a damp area on the sheet of paper or even to a "squash" where the paper is destroyed.

At present the cloths and the felts of this type of transporter are most frequently cleaned by rinsers using water at high pressure. In the paper industry the cloths known as "drying" cloths are sometimes cleaned with jets of steam. When they are too clogged they are removed from the machine and cleaned externally, by brushing, jets of steam, immersion in a bath containing solvents, etc.

The rinsers known until now are composed essentially of a tube on to which are fixed nozzles which project a high pressure fluid perpendicularly to the sheet to be cleaned. The jets emitted by these nozzles may be either fan-shaped or cylindrical. In the latter case, the jets are known as "needle" jets. Certain rinsers even include alternating nozzles, that is to say, that they project fan-shaped jets and "needle" jets at the same time. In this case, they are generally given a reciprocating movement so that each "needle" jet (of which the cleaning capacity is superior to that of a fan-shaped jet) may sweep a greater surface of the cloth.

This known solution presents numerous disadvantages. First of all, each needle jet describes a permanent sine curve on the cloth, and it is evident that certain parts of the cloth are never subject to its action. In addition, since each needle jet is supposed to remove at one application the impuri' 'dged in the cloth for a variable length of time, it is necessary to make it operate at very high pressure, which often results in damage to the cloth subject to its action. In fact, none of the known rinsers gives really satisfactory results, for:

- the rinsers with fan-shaped jets deliver a fluid with insufficient kinetic energy;
- the rinsers with needle jets define too small a working zone for each jet.

To avoid these disadvantages, various attempts have been made to deliver a continuous curtain of high pressure rinsing fluid over all the width of the cloth. All these known attempts have failed, owing to the prohibitive fluid consumption observed on this type of equipment. It is, in fact, important to know that the fluid used (in general water with various additives) most of the time contains impurities in suspension. These impurities have a tendency to block the nozzles. When needle jets are delivered by nozzles with orifices of a diameter of 1 to 2 mm, it is necessary to use filtered water. To avoid nozzle blocking, which interrupts the operation of the machine, the nozzles must be given a relatively large diameter. It is evident that the water consumption may become very high if the pressure and the section of the nozzles are both large. There is therefore the dilemma of two contradictory conditions, namely:

- to reduce the thickness of the jet of liquid so as to reduce the water consumption of the equipment;
- to increase the aperture of the nozzles to avoid their becoming blocked by impurities.

In practice, even with very high water consumption, it is hardly possible to exceed a pressure of 30 bars, which does not guarantee adequate cleaning in all cases.

The present invention has the aim of avoiding these disadvantages, by achieving a new unblockable rinsing apparatus, which delivers a continuous curtain of high pressure rinsing fluid with a low consumption of fluid.

A universal rinsing apparatus according to the invention comprises a hollow beam fed with rinsing liquid under pressure, of which the lower part carries a first and second longitudinal lip between which a continuous liquid curtain is projected, the thickness of the curtain being defined by the distance between these two lips. and it is characterised in that the first lip is fixed in relation to the hollow beam, whilst the second lip is defined by a bar, lying longitudinally along the lower part of the hollow beam, but able to move in a transverse direction closely perpendicular to the plane of the curtain of liquid, the displacement taking place between:

-a rear chamber in which there is a pressure which tends to repel the bar and its movable lip in the direction of the fixed lip;

- a stop fixed to the beam and against which the moving bar can come to bear under the effect of its rear thrust.

It will be understood that the position of the stop or stops which check the moving bar defines the width of the gap between the two lips, that is to say, the thickness of the curtain of w

According to a method of man.. -cture preferred

by the invention, the stops are constituted by an adjustable micrometric assembly, which allows the thickness of the curtain of water to be adjusted in relation to each of its applications.

According to another characteristic of the invention, at the front of the movable bar there is a front chamber in which there is the liquid under pressure which feeds the curtain of water. This chamber lies between the movable bar and the fixed section which carries the fixed lip. The hydraulic pressure in this front chamber tends to repel the moving bar transversely against the pressure to which it is subjected by the pressure in its rear chamber. It will then be understood that it is only necessary to adjust the relative values of these two pressures to cause the transverse movement of the movable bar in one direction or the other. Owing to this arrangement, the user has the possibility of releasing the pressure in the rear chamber, which has the effect of momentarily separating the two lips, to clear impurities which may be lodged there. This operation of automatic unblocking may be carried out in a very short time, even while the machine is working. Thus it is possible to form a very narrow gap between the two lips which defines a particularly penetrating jet of liquid.

Experience has shown that a rinsing liquid under a feed pressure between 0 and 70 bars may thus be used. This ensures a cleaning which is distinctly more efficient than with the known equipment in this field.

By way of example, specific embodiments of the invention will now be described, with reference to the accompanying drawings, in which:-

Figure 1 is an overall view of an embodiment of universal rinser according to the invention;

Figure 2 is a partial sectional perspective view of the beam of the embodiment shown in Figure 1; and

Figure 3 is a view similar to Figure 2 but showing the beam of an alternative embodiment.

The universal rinser according to the first embodiment of the invention, as shown in Figures 1 and 2 of the drawings, is constituted by a transverse beam 1 arranged above the belt 2 to be cleaned. This belt may be cloth or felt. It circulates on the rollers 3 as indicated by the arrow 4.

The beam 1 is arranged transversely above the belt 2 perpendicularly to the direction of its movement, and it projects on to the belt a curtain of rinsing liquid 5. The supply of rinsing liquid is provided at one end by a tube 6.

The liquid curtain 5 is continuous. It is ejected between two longitudinal lips 7 and 8 formed in the lower part of the beam 1. The thickness of the liquid curtain is defined by the width of the gap 9 which separates the two lips 7 and 8.

The beam 1 is hollow, and it forms in its upper part a first longitudinal chamber 10 into which the rinsing fluid coming from the tube 6 is sent. The base of the first chamber 10 communicates by perforations 11 with a second chamber 12 or front chamber, of which the lower part opens towards the exterior through the longitudinal gap 9. In front of the chamber 12 lies the first lip 7 which is fixed in relation to the body 13 of the beam 1.

On the contrary, the lip 8 is attached to a longitudinal bar 14 which may move in relation to the body 13 of the beam 1 in the transverse direction indicated by the double arrow 15. This bar 14 may move between the second (front) chamber 12 and a third chamber 16, or rear chamber, which is fed by fluid under pressure by a pipe 17. Sliding sealing joints 18 ensure the sealing of the upper face of the movable bar 14 in relation to the fixed body 13 of the beam 1. A flexible compression sealing joint 20 ensures the sealing of the rear of the bar 14 in relation to the fixed body 13.

If the pressure in the rear chamber 16 is preponderant, it will be understood that the longitudinal bar 14 will be thrust in the direction of the fixed lip 7, that is to say moved in the direction which tends to reduce the width 9 of the gap, that is finally the thickness of the liquid curtain 5. Micrometric stop screws 19 are distributed along the fixed body 13 above the fixed lip 7 in order to limit the forward movement of the movable bar 14. Under a preponderant pressure in the chamber 16, the bar 14 will therefore come to bear on the end of the micrometric screws 19, the adjustment of which will allow the width 9 of the gap to be precisely defined.

The operation is as follows:

As previously indicated the user sets the thickness of the liquid curtain 5 by adjusting the micrometric stops 19. This allows this thickness to be set with great precision, down to such small values as, for example, 50 microns. Because of the presence of several micrometric screws 19 distributed along the beam 1, a constant width 9 is guaranteed for the gap throughout the length of the bar 1, even for values as small as about 50 microns.

In normal operation therefore an extremely penetrating rinsing curtain 5 is formed, owing both to its small thickness and to the high speed pressure (rising up to 70 bars). This ensures both an effective unclogging of the belt 2 and a low consumption of liquid for the whole of the apparatus.

When an impurity carried by the fluid in the feed pipe 6 reaches the beam 1, it passes into the chamber 10, then 12, before coming to lodge between the two lips 8 and 9 where it remains held because of their small separation.

In order to unblock the gap 9, that is to say to eject impurities from it, it is only necessary to reduce the pressure in the rear chamber 16, so that the pressure in the front chamber 12 becomes preponderant, and it thrusts the bar 14 rearwards, so that the movable lip 8 separates from the fixed lip 7. Instantly the width 9 of the gap is considerably increased and the impurities ejected. Immediately afterwards the preponderant pressure is re-established in the rear chamber 16, which thrusts the bar 14 forwards until it comes to bear on the stop screws 19. It is clear that this operation may be carried out in a very short time whilst the machine is working and without need to disturb its operation.

There is shown in Figure 3 another manufacturing variant in which the bar 14 is provided with transverse pistons such as 20, distributed at intervals along its length. Each piston 20 comprises a head 22 projecting across the chamber 12, so as to slide

by the invention, the stops are constituted by an adjustable micrometric assembly, which allows the thickness of the curtain of water to be adjusted in relation to each of its applications.

According to another characteristic of the invention, at the front of the movable bar there is a front chamber in which there is the liquid under pressure which feeds the curtain of water. This chamber lies between the movable bar and the fixed section which carries the fixed lip. The hydraulic pressure in this front chamber tends to repel the moving bar transversely against the pressure to which it is subjected by the pressure in its rear chamber. It will then be understood that it is only necessary to adjust the relative values of these two pressures to cause the transverse movement of the movable bar in one direction or the other. Owing to this arrangement, the user has the possibility of releasing the pressure in the rear chamber, which has the effect of momentarily separating the two lips, to clear impurities which may be lodged there. This operation of automatic unblocking may be carried out in a very short time, even while the machine is working. Thus it is possible to form a very narrow gap between the two lips which defines a particularly penetrating jet of liquid.

Experience has shown that a rinsing liquid under a feed pressure between 0 and 70 bars may thus be used. This ensures a cleaning which is distinctly more efficient than with the known equipment in this field.

By way of example, specific embodiments of the invention will now be described, with reference to the accompanying drawings, in which:-

Figure 1 is an overall view of an embodiment of universal rinser according to the invention;

Figure 2 is a partial sectional perspective view of the beam of the embodiment shown in Figure 1; and

Figure 3 is a view similar to Figure 2 but showing the beam of an alternative embodiment.

The universal rinser according to the first embodiment of the invention, as shown in Figures 1 and 2 of the drawings, is constituted by a transverse beam 1 arranged above the belt 2 to be cleaned. This belt may be cloth or felt. It circulates on the rollers 3 as indicated by the arrow 4.

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The beam 1 is hollow, and it forms in its upper part a first longitudinal chamber 10 into which the rinsing fluid coming from the tube 6 is sent. The base of the first chamber 10 communicates by perforations 11 with a second chamber 12 or front chamber, of which the lower part opens towards the exterior through the longitudinal gap 9. In front of the chamber 12 lies the first lip 7 which is fixed in relation to the body 13 of the beam 1.

On the contrary, the lip 8 is attached to a longitudinal bar 14 which may move in relation to the body 13 of the beam 1 in the transverse direction indicated by the double arrow 15. This bar 14 may move between the second (front) chamber 12 and a third chamber 16, or rear chamber, which is fed by fluid under pressure by a pipe 17. Sliding sealing joints 18 ensure the sealing of the upper face of the movable bar 14 in relation to the fixed body 13 of the beam 1. A flexible compression sealing joint 20 ensures the sealing of the rear of the bar 14 in relation to the fixed body 13.

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There is shown in Figure 3 another manufacturing variant in which the bar 14 is provided with transverse pistons such as 20, distributed at intervals along its length. Each piston 20 comprises a head 22 projecting across the chamber 12, so as to slide

while retaining a seal in a bore 23 in the body 13. This bore has an intake for fluid under pressure 24.

In addition, on the opposite face of the bar 14 each piston 20 projects in a stem 25 which slides while forming a seal in a bore 26 of the body 13. The end of the stem 25 opens into a passage 27 connected to an inlet for fluid under pressure 28.

Finally, the central part of each piston 20 is attached to the bar 14, for example by a threaded section 29.

The pistons 20 plays a double role, namely:

- on the one hand they carry out a guidance function for the transverse movements of the bar 14 (double arrow 15);
- on the other hand they allow these transverse movements to be positively controlled, even if stiff points were to appear, for example, because of the deformability of a bar 14 of great length. In fact, it would be sufficient to transmit the pressure at 24 into all the bores 23 to enlarge the gap 9 (automatic unblocking), then to send the pressure at 28 into all the passages 27 to "re-close" the gap 9 by bringing the bar 14 to bear on its regulating screws 19.

It will be noted in particular that the opening and closing pressures at 24 and 28 are independent of the operating pressure obtaining in the chambers 10 and 12.

The invention is not restricted to the details of the foregoing embodiments.

CLAIMS

1. A universal rinsing apparatus comprising a hollow beam which can be supplied with rinsing liquid under pressure, of which the lower part comprises first and second longitudinal lips between which a continuous liquid curtain can be projected, its thickness being defined by the gap between these two lips, the first lip being fixed in relation to the hollow beam, whilst the second lip is formed by a bar lying longitudinally along the lower part of the hollow beam, but able to move in a transverse direction closely perpendicular to the plane of the curtain of liquid, these movements being carried out between:

- a rear chamber in which there reigns a pressure which tends to repel the bar and its movable lip in the direction of the fixed lip;
- at least one stop fixed to the beam against which the movable bar can come to bear by the effect of the rear pressure in the rear chamber.

2. A universal rinsing apparatus according to claim 1, in which the position of the stop or stops which check the movable bar defines the width of the gap between the two lips, that is to say the thickness of the liquid curtain.

3. A universal rinsing apparatus according to claim 1 or claim 2, in which the stop or stops are constituted by an assembly of adjustable micrometric screws, which allow the adjustment of the thickness of the liquid curtain in relation to each of the applications of the apparatus.

4. A universal rinsing apparatus according to any one of the preceding claims, in which there is provided at the front of the movable bar, between the latter and the fixed body which supports the fixed lip, a front chamber in which there is, in use, the liquid under pressure which feeds the curtain of water, the hydraulic pressure in this front chamber tending to repel the movable bar against the thrust to which it is subjected by the pressure in the rear chamber, so that it is sufficient to adjust the relative values of these two pressures to cause the transverse displacement of the movable bar in one direction or the other.

5. A universal rinsing apparatus according to any one of the preceding claims, in which at least one sliding sealing joint ensures the sealing of the upper face of the movable bar in relation to the fixed body of the beam.

6. A universal rinsing apparatus according to any one of the preceding claims, in which a flexible compression joint ensures the sealing of the rear of the bar in relation to the fixed body of the beam.

7. A universal rinsing apparatus according to any one of the preceding claims, in which the hollow beam forms in its upper part a first chamber which receives the supply of liquid, this first chamber communicating by perforations, distributed along the beam, with the second chamber which opens to the exterior through the gap, whilst the third chamber, located at the rear of the movable bar, is fed by fluid under pressure through a separate feed pipe.

8. A universal rinsing apparatus according to any one of the preceding claims, in which the movable bar comprises at least one transverse piston which projects from it on either side, on the one side by a head sliding in a bore in the body provided with an inlet for fluid under pressure and on the other side by a stem sliding in a passage in the body provided with an inlet for fluid under pressure.

9. A universal rinsing apparatus according to claim 8, in which the central part of each piston carries a threaded section fixed to the bar through which it passes.

10. A universal rinsing apparatus constructed and arranged substantially as herein described, with reference to Figures 1 and 2 or Figure 3 of the accompanying drawings.

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